

# **DRAFT**

## **Appendix B**

### **Selection of the Area for Remedial Action and Supporting Human Health Risk Assessment**

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The purposes of this appendix are (1) to describe the evaluation used to identify the area where remedial action is appropriate for soil (the Selected Area) at the Rolling Knolls Landfill Superfund Site located in the Township of Chatham, Morris County, New Jersey (the “Site”) and (2) to evaluate the risk to human health associated with soil that is not located within the Selected Area. To evaluate risk to human health associated with the soil that are not located within the Selected Area, the Exposure Point Concentration (EPC) of polychlorinated biphenyls (PCBs) in soil, the primary risk driver, was calculated and compared to a calculated Risk-Based Concentration (RBC) based on the Rolling Knolls Landfill Superfund Site Baseline Human Health Risk Assessment Update (BHHRA Update) dated July 5, 2018 and included in this appendix as Attachment B-1. In addition to this risk-based approach, an Alternative Remediation Standard (ARS) for PCBs was developed in accordance with New Jersey Department of Environmental Protection (NJDEP) methods, as provided in Appendix A to the Feasibility Study Report. This evaluation demonstrates that remediating the Selected Area is protective of human health, and the EPC for PCBs in soil that is not located within the Selected Area is below both the applicable RBC and ARS.

#### **BACKGROUND INFORMATION**

##### **Site Features**

The Site is a former municipal landfill in use from the 1930s to 1968. It consists of approximately 140 acres of landfill, with an adjacent 30-acre area west of the landfill that has debris scattered on the surface, but no buried waste (known as the Surface Debris Area). The Site features are shown on Figure B-1. Most of the landfill and the Surface Debris Area are privately owned. Approximately 35 acres of the landfill are on the Great Swamp National Wildlife Refuge (GSNWR).

##### **Current Uses**

A small building known as the Hunt Club is located in the Surface Debris Area near the western boundary of the landfill; it is generally unoccupied but is used infrequently for

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social gatherings. Two areas of the Site (Landscaper Areas 1 and 2) are leased to landscaping firms for the storage of trucks and equipment. The laydown area, a small area of the Site north of the landfill, is used by Chatham Disposal and South Orange Disposal for the storage of roll offs. A Shooting Range and Baseball Field, located north of the landfill boundary, are used infrequently for recreation; however, no waste materials have been observed at the Shooting Range or Baseball Field.

### **Previous Risk Assessments**

The Baseline Human Health Risk Assessment<sup>1</sup> (BHHRA) prepared by CDM Federal Programs Corporation (CDM Smith) in June 2014 calculated individual constituent and cumulative reasonable maximum exposure (RME) and central tendency exposure (CTE) cancer and non-cancer risks for current and reasonably anticipated future exposure scenarios and receptors, including adolescent and adult trespassers. The individual constituent RME cancer risks were less than United States Environmental Protection Agency (USEPA) target values for the receptors evaluated. The individual constituent RME non-cancer risks were greater than the USEPA target value (hazard index, HI) of 1 for adolescent and adult trespassers only. The non-cancer health hazard drivers are primarily PCBs for these receptors. The July 2018 BHHRA Update (Attachment B-1) evaluated changes to the exposure frequency for trespassers as well as updated toxicity information. No changes to the conclusions of the June 2014 BHHRA resulted from this update.

### **Anticipated Future Use**

There are operations currently being conducted on the landfill (the Hunt Club and two landscaper areas), but it is assumed that these activities will not continue beyond the completion of the soil remedial action at the Site. No future residential, industrial, commercial, recreational, or other use of the Site is anticipated.

### **IDENTIFICATION OF THE SELECTED AREA**

The Selected Area was identified by evaluating the locations and concentrations of the soil samples collected from the Site. Review of the data identified a contiguous area of sample locations with soil concentrations of PCBs as the sum of total Aroclors above 10 milligrams

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<sup>1</sup> An evaluation of ecological risk is included as Appendix C to the Feasibility Study Report.

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per kilogram (mg/kg) (the Selected Area)<sup>2</sup>. The impact of remediating the Selected Area was then assessed by calculating the 95 percent upper confidence limit of the mean (95UCL) for PCBs (as the sum of Aroclors) in soil outside of this area using the USEPA's ProUCL version 5.1.002.

The Selected Area includes more locations with elevated PCB concentrations, when compared to other areas of the Site, that are in close proximity to one another. A remedial approach that addresses the Selected Area will provide Site-wide risk reduction to below USEPA's acceptable risk range and takes into account the reasonably anticipated future use, the location near the GSNWR and environmentally regulated areas, as well as the rural nature and limited access to the Site. Therefore, the Selected Area was identified to achieve overall risk reduction at the Site.

The location of the Selected Area is shown on Figure B-1. It is in the northern portion of the landfill and is approximately 25 acres in extent.

Because, as described below, the EPC calculated for PCBs in readily accessible (within two feet of the ground surface) soil outside the 25-acre Selected Area (3.5 mg/kg) is significantly lower than the calculated RBC (29 mg/kg) and below the applicable ARS (5 mg/kg), the Selected Area is conservative in its size and location.

## **DEVELOPMENT OF THE SITE-SPECIFIC RISK-BASED CONCENTRATION**

An RBC was developed as a point of comparison for the results of the risk evaluation of soil outside the Selected Area (discussed below). The adolescent trespasser receptor was used as the basis to develop the RBC because it was the receptor with the highest potential health hazard. The RBC was calculated for PCBs, specifically non-dioxin-like PCBs, because it is the only analyte with a hazard index (HI) above 1.

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<sup>2</sup> The RBC was originally calculated as 10 mg/kg based on the 2014 BHHRA, prior to the July 2018 BHHRA Update, which was used to calculate an RBC of 29 mg/kg. The Selected Area was not adjusted based on the RBC calculated herein.

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**Receptor: Adolescent Trespasser (Landfill)**

	BHHRA Update's EPC (mg/kg)	Soil Combined Dermal, Ingestion, and Inhalation HI	Site-Specific RBC (mg/kg)
Non-dioxin-like PCBs	57	2	29

Notes:

1. The Site-specific RBC was calculated according to the following equation:

$$RBC = EPC \times \frac{\text{Target HI (1)}}{\text{Analyte HI (2)}}$$

2. The Site-specific RBC is rounded to two significant figures.
3. The EPC and Soil Combined Dermal, Ingestion, and Inhalation HI for Non-dioxin-like PCBs are from the July 2018 BHHRA Update (Attachment B-1).

**EXPOSURE POINT CONCENTRATION OUTSIDE THE SELECTED AREA**

To evaluate the residual risk to human health associated with the soil outside the Selected Area, the EPC for PCBs was calculated. PCBs were selected for this analysis because they are the primary risk driver and the only constituent with an individual constituent hazard index above 1. Because the PCB congener (non-dioxin-like PCBs) dataset was too small to support the evaluation of the risk to human health associated with the soil within two feet of ground surface outside the Selected Area, Aroclor data (for which there was greater data density) was used. Evaluating total PCBs as the sum of Aroclors instead of evaluating only non-dioxin-like PCBs is more conservative from a human health risk perspective.

USEPA's ProUCL version 5.1.002 was used to calculate the 95UCL as the EPC for PCBs (as the sum of Aroclors) for the shallow soil (0-2-foot depth interval) outside the Selected Area as this would be accessible to an adolescent trespasser. The EPC for PCBs remaining outside the Selected Area was calculated as 3.5 mg/kg, below the PCB RBC of 29 mg/kg as well as below the calculated PCB ARS of 5 mg/kg. The ProUCL input and output are included in Attachment B-2 to this appendix. The dataset used in the development of the

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EPC excluded the soil samples shown in brown in Figure B-2. The rationale for exclusion is described in the previous discussion about identifying the Selected Area.

## **CONCLUSIONS**

The EPC for PCBs in the soil outside the Selected Area is 3.5 mg/kg, which is well below the RBC of 29 mg/kg and below the ARS of 5 mg/kg. The extent of the Selected Area may be re-evaluated using the same methodology set forth herein, if the pre-design investigation generates additional relevant data.

Remediating the Selected Area is protective of the health of potential human receptors at the Site. However, to supplement the Selected Area and further reduce risk, those sample locations which contain PCB concentrations greater than three times the ARS of 5 mg/kg are designated Areas of Particular Concern (APCs; discussed in Section 5 of the Feasibility Study Report) and will be remediated. The locations of the APCs are included on Figure B-2.

This memorandum and its findings will be incorporated into the Feasibility Study Report for the Rolling Knolls Site.

## **REFERENCES**

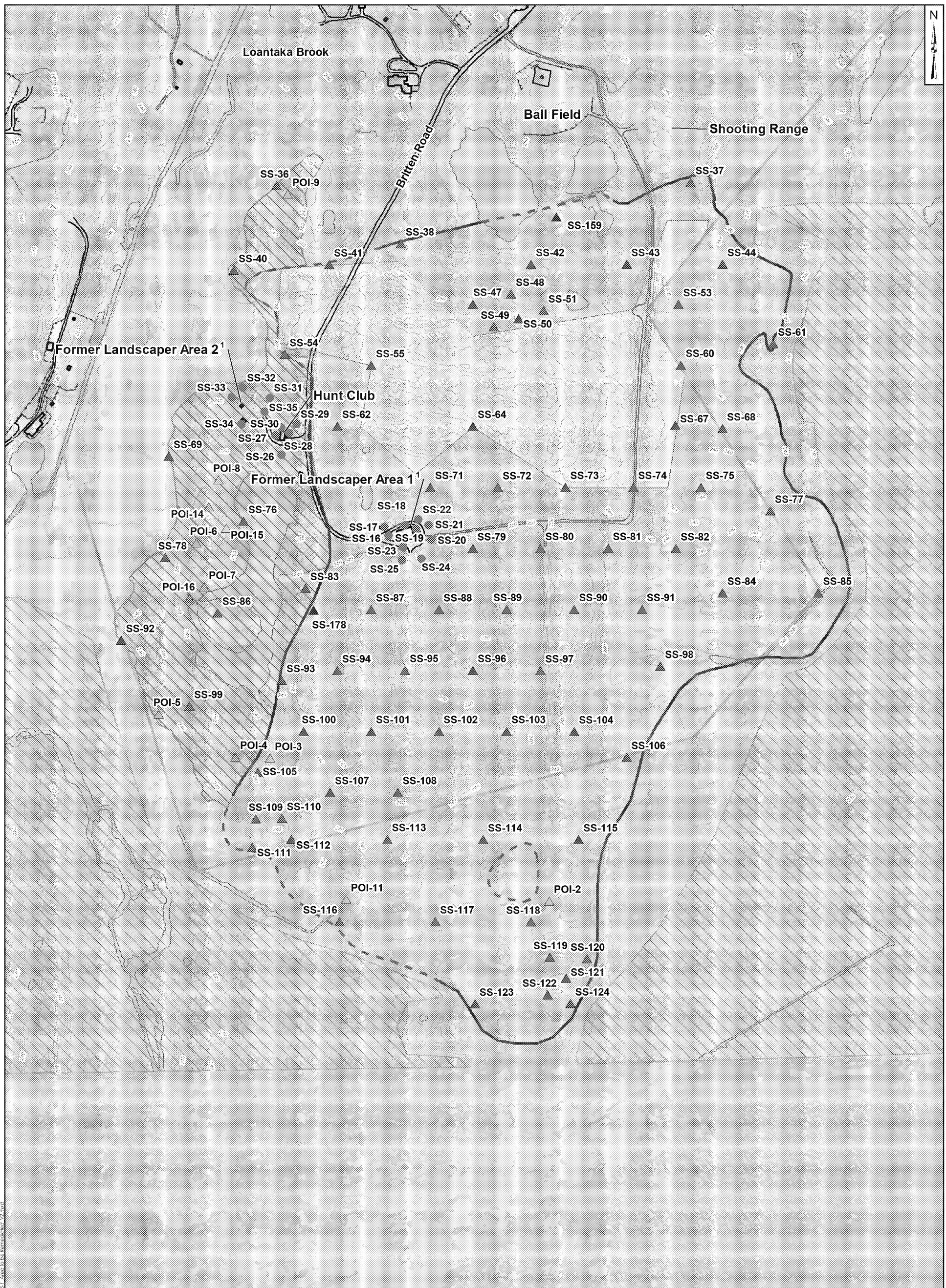
CDM Federal Programs Corporation, 2014. *Baseline Human Health Risk Assessment, Rolling Knolls Landfill Superfund Site, Chatham, New Jersey*. June.

Integral Consulting. 2016. *Baseline Ecological Risk Assessment, Rolling Knolls Landfill Superfund Site*. September.

USEPA, 2016. *ProUCL version 5.5.002*. June 20. <https://www.epa.gov/land-research/proucl-software>.

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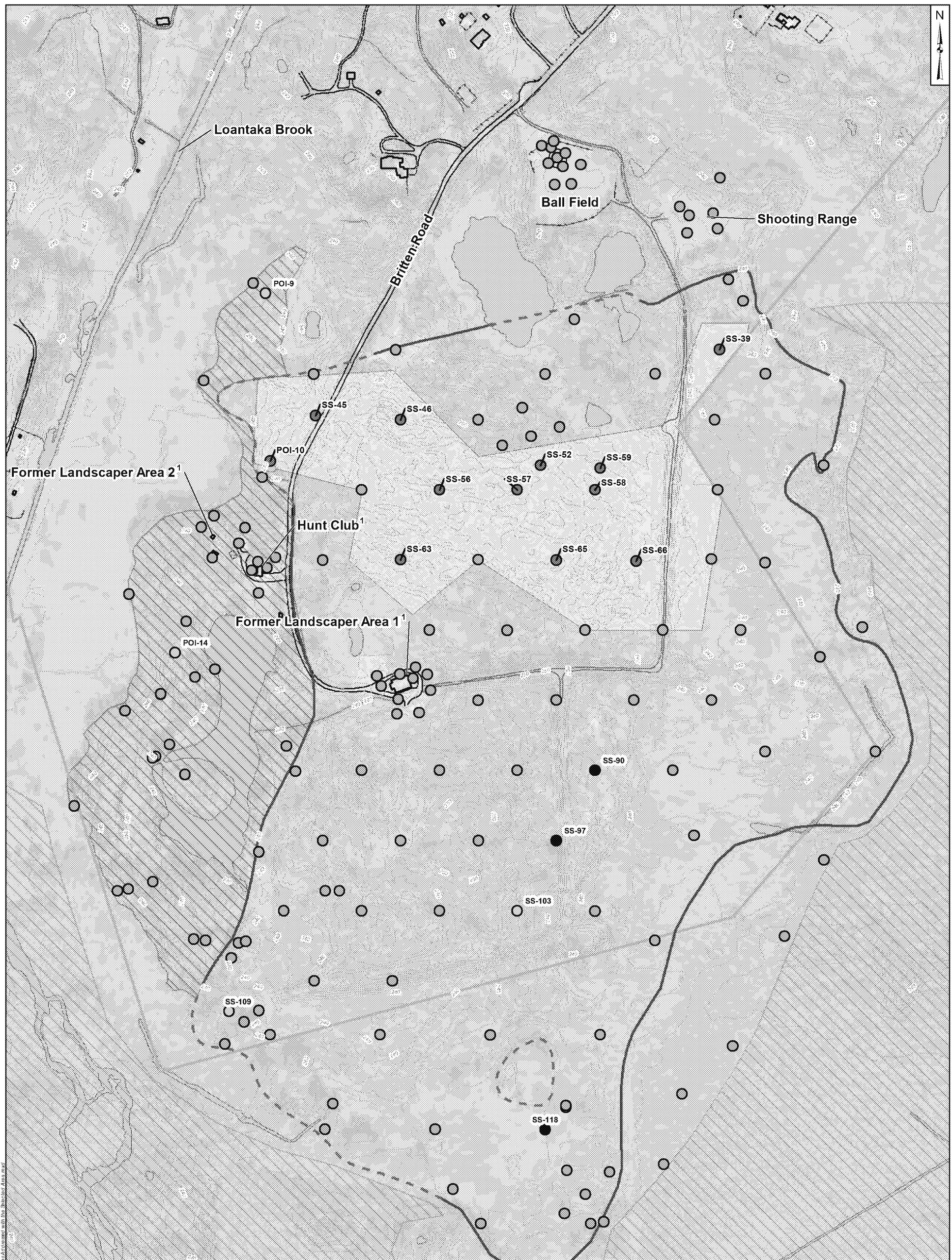
## FIGURES



Note 1: These features to be removed from landfill area prior to completion of soil remedy.  
 Site Plan created from Arcadis CAD drawings received December 2015.  
 Aerial imagery accessed via ArcGIS Online and provided by the United States Department of Agriculture on 10 July 2018. Image is dated 31 July 2015.

400 200 0 400 Feet

<b>Legend</b> Locations of Soil Samples Used to Calculate Exposure Point Concentration Selected Area Edge of landfilled wastes (dashed where approximate) Great Swamp National Wildlife Refuge property boundary Areas where surface water flow does not exhibit typical bed and bank morphology Waste and debris observed on ground surface but not observed or anticipated below ground surface Open water  Soil Sample Location Near Areas of Current Human Use (First Phase of RI) Soil Sample Location At Point of Interest (First Phase of RI) Other Soil Sample Location (First Phase of RI) Soil Sample Location (Second Phase of RI)	<b>Selected Area to be Remediated</b> <b>ROLLING KNOTS LANDFILL SUPERFUND SITE</b> <b>CHATHAM, NEW JERSEY</b>	<b>Figure</b> <b>B-1</b>
	Princeton, NJ	July 2018



Legend	Selected Area	Soil Samples Addressed with the Selected Area	Figure
Soil Samples Excluded from EPC Dataset	Edge of landfilled wastes (dashed where approximate)	ROLLING KNOTS LANDFILL SUPERFUND SITE	B-2
Areas of Particular Concern - PCBs	Great Swamp National Wildlife Refuge property boundary	CHATHAM, NEW JERSEY	
Areas of Particular Concern - Other Constituents	Areas where surface water flow does not exhibit typical bed and bank morphology		
Other Soil Samples	Waste and debris observed on ground surface but not observed or anticipated below ground surface	<b>Geosyntec</b> consultants	
	Open water	Princeton, NJ	July 2018

ATTACHMENT B-1  
JULY 2018 BHHRA UPDATE



**U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION II**  
Emergency and Remedial Response Division  
290 Broadway, 18th Floor  
New York, New York 10007-1866

**MEMORANDUM**

TO: Betsy Donovan  
Supinderjit Kaur

FROM: Michael Sival *Michael Sival*

DATE: July 5, 2018

RE: Rolling Knolls Landfill Superfund Site Baseline Human Health Risk Assessment Update

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The purpose of this memorandum is to update components of the Baseline Human Health Risk Assessment (BHHRA) that was conducted for the Rolling Knolls Landfill Superfund site. The BHHRA was completed by CDM Smith for EPA in June 2014. This report was developed using exposure information identified at the time to represent reasonable maximum exposure (RME) scenarios that reflected both current and potential future uses of the site, as well as incorporate current toxicological information on the contaminants of potential concern. This memorandum specifically addresses three components of the BHHRA: (1) exposure frequency, (2) toxicity information and (3) lead.

During the development of the BHHRA, toxicity information was identified following EPA's hierarchy of sources, including IRIS, NCEA, and appropriate Tier 3 values. Additionally, an exposure frequency of 143 days/year for the adolescent and adult trespasser was selected to represent the RME scenario. The value of 143 day/year accounts for exposure 5 times/week during the 13 weeks of summer and 3 times/week during the 26 weeks of spring and fall. The BHHRA used this toxicity information and these exposure frequencies to estimate risk to the adolescent and adult trespasser to the landfill, and concluded that the noncancer hazard index for the adolescent trespasser was 5, while the noncancer hazard index for the adult trespasser was 4. Both of these hazard estimates exceed EPA's acceptable level of less than or equal to 1. Cancer risks for these populations were below or within EPA's acceptable level of  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$ .

Discussions about the potential for exposure to trespassers throughout the landfill area were initiated during the development of the Feasibility Study (FS), after the BHHRA was approved by EPA. These discussions focused on the limited accessibility to the landfill, the lack of established trails and walking paths, and the dense vegetation that is common throughout the landfill area. During the effort to develop Alternate Remediation Standards (ARS) that would be used to assess cleanup alternatives in the FS, the exposure frequency of trespassers to the landfill was reevaluated, with these characteristics of the site in mind. After careful consideration of these factors, EPA concluded that the exposure frequency of 143 days/years likely overestimated the RME scenario and identified a value of 84 days/year as an exposure frequency that more accurately represented the RME scenario. This value, which was selected as part of the process to develop ARS for the site, is based on the following:

- When school is out for the summer months (June, July and August), exposure would occur 3 days per week;

- During the spring (April and May) and fall (September, October and November), exposure would occur 2 days per week;
- For those months when the average high temperatures are less than 50 degrees (January, February, March and December), exposure would not occur.

These exposures are presented in the following table:

Month	# Days per Month	Weekly Exposure Frequency (days/week)	Monthly Exposure Frequency (days/month)
April	30	2	9
May	31	2	9
June	30	3	13
July	31	3	13
August	31	3	13
September	30	2	9
October	31	2	9
November	30	2	9
		Total Exposure Frequency (days/year)	84

During the development of the ARS, toxicity values were also re-examined. Toxicity information for all contaminants of potential concern (COPCs) that were quantitatively evaluated in the BHHRA was verified to ensure that the ARS were developed using up-to-date information. This review identified that toxicity information for several COPCs had been updated since the 2014 BHHRA was approved. Specifically, the toxicity information for polycyclic aromatic hydrocarbons (PAHs), as well as a few other COPCs, had been updated in IRIS and from other sources. The following table shows the updated toxicity information used to develop the ARS:

Chemical	RfD (mg/kg-day)	Absorbed RfD (mg/kg-day)	SF (mg/kg-day) <sup>-1</sup>	Absorbed SF (mg/kg-day) <sup>-1</sup>	Source
Benzo(a)pyrene	3E-04	3E-04	1E+00	1E+00	IRIS
Benzo(a)anthracene	NA	NA	1E-01	1E-01	USEPA
Benzo(b)fluoranthene	NA	NA	1E-01	1E-01	USEPA
Benzo(k)fluoranthene	NA	NA	1E-02	1E-02	USEPA
Chrysene	NA	NA	1E-03	1E-03	USEPA
Dibenz(a,h)anthracene	NA	NA	1E00	1E00	USEPA
Indeno(1,2,3-cd)pyrene	NA	NA	1E-01	1E-01	USEPA
PCB TEQ	NA	NA	1.3E+05	1.3E+05	CalEPA
2,3,7,8-TCDD	NA	NA	1.3E+05	1.3E+05	CalEPA
4,4'-DDT	3E-05	3E-05	NC	NC	PPRTV-S

NA: No toxicity value is available.

NC: No change from the BHHRA.

PPRTV-S: Provisional Peer Reviewed Toxicity Value - Screening

Since the exposure frequency for the adolescent and adult trespassers was revised to 84 days/year from 143 days/year and toxicity information was updated for certain COPCs, the noncancer hazards for these were recalculated to assess if the hazards remained above EPA's acceptable level. The noncancer

hazard index for the adolescent trespasser was estimated to be 3, while the value for the adult trespasser was estimated to be 2. Both of these values still exceed EPA's acceptable level.

Finally, lead concentrations at the site were reevaluated. In 2016, EPA released a directive focusing on lead. In OLEM Directive 9200.2-167, "Updated Scientific Considerations for Lead in Soil Cleanups", blood lead levels less than 10 ug/dl were identified as associated with health concerns. In response to this directive, Region 2 developed a policy to evaluate how lead is assessed at sites. One outcome of this updated approach is to review data to identify if any soil sample results exceed 200 mg/kg. This is a change from the approach used in the 2014 BHHRA, which used a value of 400 mg/kg to identify areas that require further review. Lead was identified as requiring further action during the 2014 BHHRA, and this remains a valid conclusion after the review using the revised screening level of 200 mg/kg.

In summary, this memorandum reviewed three components of the 2014 BHHRA. This review, which included updates to exposure frequency, toxicity information, and lead, concluded that the results of the 2014 BHHRA remain valid, that actionable risk is present at the Rolling Knolls Landfill Superfund Site.

/MAS

TABLE 7.7.RME  
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
ROLLING KNOLLS LANDFILL SUPERFUND SITE

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adolescent (1)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				Non-Cancer Hazard Calculations					
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Landfill	Ingestion	Volatile Organic Compounds	1.2E+00	mg/kg	9.9E-08	mg/kg-day	5.5E-02	(mg/kg-day) <sup>-1</sup>	5.4E-09	5.8E-07	mg/kg-day	4.0E-03	mg/kg-day	1.4E-04
				Chloroform	1.2E+02	mg/kg	9.8E-06	mg/kg-day	3.1E-02	(mg/kg-day) <sup>-1</sup>	3.0E-07	5.7E-05	mg/kg-day	1.0E-02	mg/kg-day	5.7E-03
				Trichloroethene	4.1E-02	mg/kg					2.1E-10	1.9E-08	mg/kg-day	5.0E-04	mg/kg-day	3.9E-05
				Total xylenes	7.3E+03	mg/kg	6.0E-04	mg/kg-day	NA	NA	NA	3.5E-03	mg/kg-day	2.0E-01	mg/kg-day	1.7E-02
				Semi-Volatile Organic Compounds												
				Benzo(a)anthracene	5.1E+00	mg/kg										
				Benzo(a)pyrene	4.5E+00	mg/kg										
				Benzo(b)fluoranthene	5.0E+00	mg/kg										
				Benzo(k)fluoranthene	4.1E+00	mg/kg										
				Bis(2-ethyl hexyl) phthalate	1.3E-01	mg/kg	1.0E-06	mg/kg-day	1.4E-02	(mg/kg-day) <sup>-1</sup>	1.1E-07	2.5E-06	mg/kg-day	NA	NA	NA
				Chrysene	5.4E+00	mg/kg										
				Dibenz(a,h)anthracene	5.3E-01	mg/kg										
				Indeno(1,2,3-cd)pyrene	1.1E+00	mg/kg										
				Pesticides												
				Aldrin	1.2E-02	mg/kg	9.5E-10	mg/kg-day	1.7E+01	(mg/kg-day) <sup>-1</sup>	1.6E-08	5.6E-09	mg/kg-day	3.0E-05	mg/kg-day	1.9E-04
				alpha-BHC	1.1E-02	mg/kg	9.3E-10	mg/kg-day	6.3E+00	(mg/kg-day) <sup>-1</sup>	5.9E-09	5.4E-09	mg/kg-day	8.0E-03	mg/kg-day	6.8E-07
				alpha-Chlordane	1.8E-01	mg/kg	1.5E-08	mg/kg-day	3.5E-01	(mg/kg-day) <sup>-1</sup>	5.2E-09	8.8E-08	mg/kg-day	5.0E-04	mg/kg-day	1.7E-04
				gamma-Chlordane	2.1E-01	mg/kg	1.7E-08	mg/kg-day	3.5E-01	(mg/kg-day) <sup>-1</sup>	6.1E-09	1.0E-07	mg/kg-day	5.0E-04	mg/kg-day	2.0E-04
				Dieldrin	4.6E-02	mg/kg	3.8E-09	mg/kg-day	1.6E+01	(mg/kg-day) <sup>-1</sup>	6.1E-08	2.2E-08	mg/kg-day	5.0E-05	mg/kg-day	4.4E-04
				Heptachlor	3.9E-02	mg/kg	3.2E-09	mg/kg-day	4.5E-00	(mg/kg-day) <sup>-1</sup>	1.5E-08	1.9E-08	mg/kg-day	5.0E-04	mg/kg-day	3.8E-05
				Heptachlor epoxide	2.5E-02	mg/kg	2.0E-09	mg/kg-day	9.1E-00	(mg/kg-day) <sup>-1</sup>	1.8E-08	1.2E-08	mg/kg-day	1.3E-05	mg/kg-day	9.1E-04
				Polychlorinated Biphenyls												
				Total Non-DL PCBs Congeners	5.7E+01	mg/kg	4.7E-06	mg/kg-day	2.0E+00	(mg/kg-day) <sup>-1</sup>	9.4E-06	2.8E-05	mg/kg-day	2.0E-05	mg/kg-day	1.4E+00
				PCB TEQ	4.2E-04	mg/kg	3.5E-11	mg/kg-day	1.3E+05	(mg/kg-day) <sup>-1</sup>	4.5E-06	2.0E-10	mg/kg-day	7.0E-10	mg/kg-day	2.9E-01
				Dioxin/Furans												
				Dioxin TEQ	4.9E-04	mg/kg	4.0E-11	mg/kg-day	1.6E+05	(mg/kg-day) <sup>-1</sup>	6.3E-06	2.3E-10	mg/kg-day	7.0E-10	mg/kg-day	3.4E-01
				Inorganics												
				Aluminum	1.4E+04	mg/kg	1.1E-03	mg/kg-day	NA	NA	NA	6.5E-03	mg/kg-day	1.0E+00	mg/kg-day	6.5E-03
				Antimony	1.2E+02	mg/kg	9.8E-06	mg/kg-day	NA	NA	NA	5.7E-05	mg/kg-day	4.0E-04	mg/kg-day	1.4E-01
				Arsenic	2.6E+01	mg/kg	1.3E-06	mg/kg-day	1.5E+00	(mg/kg-day) <sup>-1</sup>	1.9E-06	7.5E-06	mg/kg-day	3.0E-04	mg/kg-day	2.5E-02
				Barium	5.3E-02	mg/kg	4.4E-05	mg/kg-day	NA	NA	NA	2.5E-04	mg/kg-day	2.0E-01	mg/kg-day	1.3E-03
				Cadmium	1.4E-01	mg/kg	1.1E-06	mg/kg-day	NA	NA	NA	6.8E-06	mg/kg-day	1.0E-03	mg/kg-day	6.8E-03
				Chromium, Total	2.9E-02	mg/kg	2.4E-05	mg/kg-day	NA	NA	NA	1.4E-04	mg/kg-day	1.5E+00	mg/kg-day	9.2E-05
				Cobalt	1.3E-01	mg/kg	1.0E-06	mg/kg-day	NA	NA	NA	6.1E-06	mg/kg-day	3.0E-04	mg/kg-day	2.0E-02
				Copper	3.1E-03	mg/kg	2.5E-04	mg/kg-day	NA	NA	NA	1.5E-03	mg/kg-day	4.0E-02	mg/kg-day	3.7E-02
				Cyanide	1.5E-01	mg/kg	1.3E-06	mg/kg-day	NA	NA	NA	7.4E-06	mg/kg-day	6.0E-04	mg/kg-day	1.2E-02
				Iron	1.3E-05	mg/kg	1.0E-02	mg/kg-day	NA	NA	NA	6.1E-02	mg/kg-day	7.0E-01	mg/kg-day	8.7E-02

TABLE 7.7.RME  
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
ROLLING KNOLLS LANDFILL SUPERFUND SITE

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adolescent (1)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				Non-Cancer Hazard Calculations					
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (cont.)	Surface Soil (cont.)	Landfill (cont.)	Ingestion (cont.)	Manganese	1.2E-03	mg/kg	9.7E-05	mg/kg-day	NA	NA	NA	5.6E-04	mg/kg-day	2.4E-02	mg/kg-day	2.3E-02
				Mercury	1.0E-01	mg/kg	8.2E-07	mg/kg-day	NA	NA	NA	4.8E-06	mg/kg-day	3.0E-04	mg/kg-day	1.6E-02
				Nickel	1.5E+02	mg/kg	1.3E-05	mg/kg-day	NA	NA	NA	7.4E-05	mg/kg-day	2.0E-02	mg/kg-day	3.7E-03
				Silver	1.0E+01	mg/kg	8.5E-07	mg/kg-day	NA	NA	NA	4.9E-06	mg/kg-day	5.0E-03	mg/kg-day	9.9E-04
				Thallium	9.7E-01	mg/kg	7.9E-08	mg/kg-day	NA	NA	NA	4.6E-07	mg/kg-day	1.0E-05	mg/kg-day	4.6E-02
				Vanadium	3.1E-02	mg/kg	2.5E-05	mg/kg-day	NA	NA	NA	1.5E-04	mg/kg-day	5.0E-03	mg/kg-day	2.9E-02
				Zinc	5.2E+03	mg/kg	4.3E-04	mg/kg-day	NA	NA	NA	2.5E-03	mg/kg-day	3.0E-01	mg/kg-day	8.3E-03
				Exp. Route Total							2.4E-05				2.5E+00	
Soil	Surface Soil	Landfill	Dermal	Volatile Organic Compounds												
				Benzene	1.2E+00	mg/kg	NA	NA	5.5E-02	(mg/kg-day) <sup>-1</sup>	NA	NA	NA	4.0E-03	mg/kg-day	NA
				Chloroform	1.2E-02	mg/kg	NA	NA	3.1E-02	(mg/kg-day) <sup>-1</sup>	NA	NA	NA	1.0E-02	mg/kg-day	NA
				Trichloroethane	4.1E-02	mg/kg					8.2E-11	NA	NA	5.0E-04	mg/kg-day	NA
				Total xylenes	7.3E-03	mg/kg	NA	NA	NA	NA	NA	NA	NA	2.0E-01	mg/kg-day	NA
				Semi-Volatile Organic Compounds												
				Benzo(a)anthracene	5.1E+00	mg/kg					4.5E-08	9.8E-07	mg/kg-day	NA	NA	NA
				Benzo(a)pyrene	4.5E+00	mg/kg					3.9E-07	8.6E-07	mg/kg-day	3.0E-04	mg/kg-day	2.9E-03
				Benzo(b)fluoranthene	5.0E+00	mg/kg					4.3E-08	9.5E-07	mg/kg-day	NA	NA	NA
				Benzo(k)fluoranthene	4.1E+00	mg/kg					3.6E-09	7.8E-07	mg/kg-day	NA	NA	NA
				Bis(2-ethyl hexyl) phthalate	1.3E+01	mg/kg	3.2E-07	mg/kg-day	1.4E-02	(mg/kg-day) <sup>-1</sup>	4.5E-09	1.9E-06	mg/kg-day	2.0E-02	mg/kg-day	9.3E-05
				Chrysene	5.4E+00	mg/kg					4.7E-10	1.0E-06	mg/kg-day	NA	NA	NA
				Dibenz(a,h)anthracene	5.3E+01	mg/kg					4.7E-08	1.0E-07	mg/kg-day	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	1.1E+00	mg/kg					9.8E-09	2.1E-07	mg/kg-day	NA	NA	NA
				Pesticides												
				Aldrin	1.2E-02	mg/kg	2.9E-10	mg/kg-day	1.7E+01	(mg/kg-day) <sup>-1</sup>	5.0E-09	1.7E-09	mg/kg-day	3.0E-05	mg/kg-day	5.7E-05
				alpha-BHC	1.1E-02	mg/kg	2.8E-10	mg/kg-day	6.3E+00	(mg/kg-day) <sup>-1</sup>	1.8E-09	1.7E-09	mg/kg-day	8.0E-03	mg/kg-day	2.1E-07
				alpha-Chlordane	1.8E-01	mg/kg	1.8E-09	mg/kg-day	3.5E+01	(mg/kg-day) <sup>-1</sup>	6.3E-10	1.1E-08	mg/kg-day	5.0E-04	mg/kg-day	2.1E-05
				gamma-Chlordane	2.1E-01	mg/kg	2.1E-09	mg/kg-day	3.5E+01	(mg/kg-day) <sup>-1</sup>	7.5E-10	1.2E-08	mg/kg-day	5.0E-04	mg/kg-day	2.5E-05
				Dieldrin	4.6E-02	mg/kg	1.2E-09	mg/kg-day	1.6E+01	(mg/kg-day) <sup>-1</sup>	1.9E-08	6.8E-09	mg/kg-day	5.0E-05	mg/kg-day	1.4E-04
				Heptachlor	3.9E-02	mg/kg	9.9E-10	mg/kg-day	4.5E+00	(mg/kg-day) <sup>-1</sup>	4.5E-09	5.8E-09	mg/kg-day	5.0E-04	mg/kg-day	1.2E-05
				Heptachlor epoxide	2.5E-02	mg/kg	6.2E-10	mg/kg-day	9.1E+00	(mg/kg-day) <sup>-1</sup>	5.7E-09	3.6E-09	mg/kg-day	1.3E-05	mg/kg-day	2.8E-04
				Polychlorinated Biphenyls												
				Total Non-DL PCBs Congeners	5.7E+01	mg/kg	2.0E-06	mg/kg-day	2.0E+00	(mg/kg-day) <sup>-1</sup>	4.0E-06	1.2E-05	mg/kg-day	2.0E-05	mg/kg-day	5.9E-01
				PCB TEQ	4.2E-04	mg/kg	1.5E-11	mg/kg-day	1.3E+05	(mg/kg-day) <sup>-1</sup>	1.9E-06	8.6E-11	mg/kg-day	7.0E-10	mg/kg-day	1.2E-01
				Dioxin/Furans												
				Dioxin TEQ	4.9E-04	mg/kg	3.7E-12	mg/kg-day	1.6E+05	(mg/kg-day) <sup>-1</sup>	5.8E-07	2.2E-11	mg/kg-day	7.0E-10	mg/kg-day	3.1E-02

TABLE 7.7.RME  
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
ROLLING KNOLLS LANDFILL SUPERFUND SITE

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adolescent (1)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				Non-Cancer Hazard Calculations					
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (cont.)	Surface Soil (cont.)	Landfill (cont.)	Dermal (cont.)	Inorganics												
				Aluminum	1.4E-04	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.0E+00	mg/kg-day	NA
				Antimony	1.2E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.0E-05	mg/kg-day	NA
				Arsenic	2.6E-01	mg/kg	2.0E-07	mg/kg-day	1.5E+00	(mg/kg-day) <sup>-1</sup>	2.9E-07	1.1E-06	mg/kg-day	3.0E-04	mg/kg-day	3.8E-03
				Barium	5.3E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.4E-02	mg/kg-day	NA
				Cadmium	1.4E-01	mg/kg	3.5E-09	mg/kg-day	NA	NA	NA	2.0E-08	mg/kg-day	2.5E-05	mg/kg-day	8.1E-04
				Chromium, Total	2.9E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	2.0E-02	mg/kg-day	NA
				Cobalt	1.3E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.0E-04	mg/kg-day	NA
				Copper	3.1E-03	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.0E-02	mg/kg-day	NA
				Cyanide	1.5E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.0E-04	mg/kg-day	NA
				Iron	1.3E-05	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.0E-01	mg/kg-day	NA
				Manganese	1.2E-03	mg/kg	NA	NA	NA	NA	NA	NA	NA	2.4E-02	mg/kg-day	NA
				Mercury	1.0E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	2.1E-05	mg/kg-day	NA
				Nickel	1.5E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	8.0E-04	mg/kg-day	NA
				Silver	1.0E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	2.0E-04	mg/kg-day	NA
				Thallium	9.7E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.0E-05	mg/kg-day	NA
				Vanadium	3.1E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.0E-03	mg/kg-day	NA
				Zinc	5.2E-03	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.0E-01	mg/kg-day	NA
				Exp. Route Total								7.4E-06			7.5E-01	
Soil	Surface Soil	Landfill	Inhalation	Volatile Organic Compounds												
				Benzene	1.2E+00	mg/kg	7.8E-04	µg/m <sup>3</sup>	7.8E-06	(µg/m <sup>3</sup> ) <sup>-1</sup>	6.1E-09	4.6E-03	µg/m <sup>3</sup>	3.0E+01	µg/m <sup>3</sup>	1.5E-04
				Chloroform	1.2E-02	mg/kg	1.2E-01	µg/m <sup>3</sup>	2.3E-05	(µg/m <sup>3</sup> ) <sup>-1</sup>	2.8E-06	7.2E-01	µg/m <sup>3</sup>	9.8E+01	µg/m <sup>3</sup>	7.3E-03
				Trichloroethane	4.1E-02	mg/kg					8.1E-09	2.8E-04	µg/m <sup>3</sup>	2.0E+00	µg/m <sup>3</sup>	1.4E-04
				Total xylenes	7.3E-03	mg/kg	2.8E+00	µg/m <sup>3</sup>	NA	NA	NA	1.6E+01	µg/m <sup>3</sup>	1.0E+02	µg/m <sup>3</sup>	1.6E-01
				Semi-Volatile Organic Compounds												
				Benzo(a)anthracene	5.1E+00	mg/kg					7.6E-12	2.1E-07	µg/m <sup>3</sup>	NA	NA	NA
				Benzo(a)pyrene	4.5E+00	mg/kg					6.8E-11	1.8E-07	µg/m <sup>3</sup>	2.0E-03	µg/m <sup>3</sup>	9.2E-05
				Benzo(b)fluoranthene	5.0E+00	mg/kg					7.5E-12	2.0E-07	µg/m <sup>3</sup>	NA	NA	NA
				Benzo(k)fluoranthene	4.1E+00	mg/kg					6.2E-13	1.7E-07	µg/m <sup>3</sup>	NA	NA	NA
				Bis(2-ethyl hexyl) phthalate	1.3E+01	mg/kg	8.9E-08	µg/m <sup>3</sup>	2.4E-06	(µg/m <sup>3</sup> ) <sup>-1</sup>	2.1E-13	5.2E-07	µg/m <sup>3</sup>	NA	NA	NA
				Chrysene	5.4E+00	mg/kg					8.1E-14	2.2E-07	µg/m <sup>3</sup>	NA	NA	NA
				Dibenz(a,h)anthracene	5.3E+01	mg/kg					8.1E-12	2.2E-08	µg/m <sup>3</sup>	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	1.1E+00	mg/kg					2.1E-12	4.6E-08	µg/m <sup>3</sup>	NA	NA	NA
				Pesticides												
				Aldrin	1.2E-02	mg/kg	8.1E-11	µg/m <sup>3</sup>	4.9E-03	(µg/m <sup>3</sup> ) <sup>-1</sup>	4.0E-13	4.8E-10	µg/m <sup>3</sup>	NA	NA	NA
				alpha-BHC	1.1E-02	mg/kg	7.9E-11	µg/m <sup>3</sup>	1.8E-03	(µg/m <sup>3</sup> ) <sup>-1</sup>	1.4E-13	4.8E-10	µg/m <sup>3</sup>	NA	NA	NA
				alpha-Chlordane	1.8E-01	mg/kg	1.3E-09	µg/m <sup>3</sup>	1.0E-04	(µg/m <sup>3</sup> ) <sup>-1</sup>	1.3E-13	7.4E-09	µg/m <sup>3</sup>	7.0E-01	µg/m <sup>3</sup>	1.1E-08
				gamma-Chlordane	2.1E-01	mg/kg	1.5E-09	µg/m <sup>3</sup>	1.0E-04	(µg/m <sup>3</sup> ) <sup>-1</sup>	1.5E-13	8.7E-09	µg/m <sup>3</sup>	7.0E-01	µg/m <sup>3</sup>	1.2E-08
				Dieldrin	4.6E-02	mg/kg	3.2E-10	µg/m <sup>3</sup>	4.6E-03	(µg/m <sup>3</sup> ) <sup>-1</sup>	1.5E-12	1.9E-09	µg/m <sup>3</sup>	NA	NA	NA
				Heptachlor	3.9E-02	mg/kg	2.8E-10	µg/m <sup>3</sup>	1.3E-03	(µg/m <sup>3</sup> ) <sup>-1</sup>	3.6E-13	1.6E-09	µg/m <sup>3</sup>	NA	NA	NA
				Heptachlor epoxide	2.5E-02	mg/kg	1.7E-10	µg/m <sup>3</sup>	2.6E-03	(µg/m <sup>3</sup> ) <sup>-1</sup>	4.5E-13	1.0E-09	µg/m <sup>3</sup>	NA	NA	NA

TABLE 7.7.RME  
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
ROLLING KNOLLS LANDFILL SUPERFUND SITE

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adolescent (1)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				Non-Cancer Hazard Calculations							
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC				
							Value	Units	Value	Units		Value	Units	Value	Units			
Soil	Surface Soil	Landfill	Inhalation	Polychlorinated Biphenyls														
				Total Non-DL PCBs Congeners	5.7E+01	mg/kg	4.0E-07	µg/m³	5.7E-04	(µg/m³)⁻¹	2.3E-10	2.4E-06	µg/m³	NA				
				PCB TEO	4.2E-04	mg/kg	2.9E-12	µg/m³	3.8E+01	(µg/m³)⁻¹	1.1E-10	1.7E-11	µg/m³	4.0E-05	µg/m³	4.3E-07		
				Dioxin/Furans														
				Dioxin TEQ	4.9E-04	mg/kg	3.4E-12	µg/m³	3.8E+01	(µg/m³)⁻¹	1.3E-10	2.0E-11	µg/m³	4.0E-05	µg/m³	5.0E-07		
				Inorganics														
				Aluminum	1.4E+04	mg/kg	9.6E-05	µg/m³	NA	NA	NA	5.6E-04	µg/m³	5.0E+00	µg/m³	1.1E-04		
				Antimony	1.2E+02	mg/kg	8.4E-07	µg/m³	NA	NA	NA	4.9E-06	µg/m³	NA	NA	NA		
				Arsenic	2.6E+01	mg/kg	1.8E-07	µg/m³	4.3E-03	(µg/m³)⁻¹	7.8E-10	1.1E-06	µg/m³	1.5E-02	µg/m³	7.1E-05		
				Barium	5.3E+02	mg/kg	3.7E-06	µg/m³	NA	NA	NA	2.2E-05	µg/m³	5.0E-01	µg/m³	4.3E-05		
				Cadmium	1.4E+01	mg/kg	9.7E-08	µg/m³	1.8E-03	(µg/m³)⁻¹	1.7E-10	5.7E-07	µg/m³	1.0E-02	µg/m³	5.7E-05		
				Chromium, Total	2.9E+02	mg/kg	2.0E-06	µg/m³	NA	NA	NA	1.2E-05	µg/m³	NA	NA	NA		
				Cobalt	1.3E+01	mg/kg	8.9E-08	µg/m³	9.0E-03	(µg/m³)⁻¹	8.0E-10	5.2E-07	µg/m³	6.0E-03	µg/m³	8.7E-05		
				Copper	3.1E+03	mg/kg	2.2E-05	µg/m³	NA	NA	NA	1.3E-04	µg/m³	NA	NA	NA		
				Cyanide	1.5E+01	mg/kg	1.1E-07	µg/m³	NA	NA	NA	6.3E-07	µg/m³	NA	NA	NA		
				Iron	1.3E+05	mg/kg	9.0E-04	µg/m³	NA	NA	NA	5.2E-03	µg/m³	NA	NA	NA		
				Manganese	1.2E+03	mg/kg	8.3E-06	µg/m³	NA	NA	NA	4.8E-05	µg/m³	5.0E-02	µg/m³	9.6E-04		
				Mercury	1.0E+01	mg/kg	7.0E-08	µg/m³	NA	NA	NA	4.1E-07	µg/m³	3.0E-01	µg/m³	1.4E-06		
				Nickel	1.5E+02	mg/kg	1.1E-06	µg/m³	2.6E-04	(µg/m³)⁻¹	2.8E-10	6.3E-06	µg/m³	9.0E-02	µg/m³	7.0E-05		
				Silver	1.0E+01	mg/kg	7.2E-08	µg/m³	NA	NA	NA	4.2E-07	µg/m³	NA	NA	NA		
				Thallium	9.7E+01	mg/kg	6.8E-09	µg/m³	NA	NA	NA	4.0E-08	µg/m³	NA	NA	NA		
				Vanadium	3.1E+02	mg/kg	2.1E-06	µg/m³	NA	NA	NA	1.3E-05	µg/m³	1.0E-01	µg/m³	1.3E-04		
				Zinc	5.2E+03	mg/kg	3.7E-05	µg/m³	NA	NA	NA	2.1E-04	µg/m³	NA	NA	NA		
				Exp. Route Total							2.8E-06				1.7E-01			
				Exposure Point Total							3.4E-05				3.4E+00			
				Exposure Medium Total							3.4E-05				3.4E+00			
				Medium Total							3.4E-05				3.4E+00			
Surface Water	Surface Water	Ponds	Dermal	Volatile Organic Compounds														
				Benzene	3.3E-01	µg/L	2.4E-08	mg/kg-day	5.5E-02	(mg/kg-day)⁻¹	1.3E-10	1.4E-08	mg/kg-day	4.0E-03	mg/kg-day	3.5E-06		
				cis-1,2-Dichloroethene	6.9E+00	µg/L	NA	NA	NA	NA	NA	NA	NA	2.0E-03	mg/kg-day	NA		
				1,4-Dioxane	4.5E+00	µg/L	7.8E-10	mg/kg-day	1.0E-01	(mg/kg-day)⁻¹	7.8E-11	4.5E-09	mg/kg-day	3.0E-02	mg/kg-day	1.5E-07		
				Trichloroethene	2.0E+00	µg/L						5.3E-09	8.0E-08	mg/kg-day	5.0E-04	mg/kg-day	1.6E-04	
				Vinyl Chloride	1.9E+01	µg/L						1.8E-07	3.0E-09	mg/kg-day	3.0E-03	mg/kg-day	1.0E-06	
				Semi-Volatile Organic Compounds														
				Dibenz(a,h)anthracene	1.8E-02	µg/L						6.1E-08	1.3E-07	mg/kg-day	NA	NA	NA	
See Calculations in Appendix G																		
See Calculations in Appendix G																		
See Calculations in Appendix G																		

TABLE 7.7.RME  
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS  
REASONABLE MAXIMUM EXPOSURE  
ROLLING KNOLLS LANDFILL SUPERFUND SITE

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adolescent (1)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				Non-Cancer Hazard Calculations										
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC							
							Value	Units	Value	Units		Value	Units	Value	Units						
Surface Water (cont.)	Surface Water (cont.)	Ponds (cont.)	Dermal (cont.)	<b>Inorganics</b>	1.7E+00	µg/L	7.0E-10	mg/kg-day	1.5E+00	(mg/kg-day) <sup>†</sup>	1.1E-09	4.1E-09	mg/kg-day	3.0E-04	mg/kg-day	1.4E-05					
					1.5E+00	µg/L	6.2E-10	mg/kg-day	NA	NA	NA	3.6E-09	mg/kg-day	2.0E-02	mg/kg-day	1.9E-07					
					1.2E+00	µg/L	4.8E-10	mg/kg-day	NA	NA	NA	2.8E-09	mg/kg-day	3.0E-04	mg/kg-day	9.4E-06					
					7.8E-03	ug/L	NA	NA	NA	NA	NA	NA	7.0E-01	mg/kg-day	NA	NA					
					3.2E-02	µg/L	1.3E-07	mg/kg-day	NA	NA	NA	7.8E-07	mg/kg-day	2.4E-02	mg/kg-day	3.2E-05					
					Exp. Route Total						2.3E-07					2.2E-04					
					Exposure Point Total						2.3E-07					2.2E-04					
					Exposure Medium Total						2.3E-07					2.2E-04					
					Medium Total						2.3E-07					2.2E-04					
Sediment	Sediment	Ponds	Dermal	<b>Semi-Volatile Organic Compounds</b>	7.3E-01	mg/kg					See Calculations in Appendix G	2.8E-10	6.2E-09	mg/kg-day	NA	NA	NA				
												4.2E-09	9.1E-09	3.0E-04	mg/kg-day	3.0E-05					
												4.7E-10	1.0E-08	mg/kg-day	NA	NA	NA				
												1.9E-11	4.2E-09	mg/kg-day	NA	NA	NA				
												3.3E-12	7.2E-09	mg/kg-day	NA	NA	NA				
												3.6E-10	7.8E-10	mg/kg-day	NA	NA	NA				
												2.5E-10	5.6E-09	mg/kg-day	NA	NA	NA				
																1.0E-04					
																1.4E-04					
																1.4E-05					
Inorganics				<b>Polychlorinated Biphenyls</b>	2.2E-01	mg/kg					See Calculations in Appendix G	6.9E-10	2.0E-09	mg/kg-day	2.0E-05	mg/kg-day	1.0E-04				
												3.5E-10	mg/kg-day	2.0E+00	(mg/kg-day) <sup>†</sup>						
												1.1E-08	4.2E-08	mg/kg-day	3.0E-04	mg/kg-day	NA				
												3.4E-10	mg/kg-day	2.5E-05	mg/kg-day	2.0E-02	mg/kg-day				
												3.4E-11	4.2E-09	mg/kg-day	NA	NA	NA				
												3.6E-12	7.2E-09	mg/kg-day	NA	NA	NA				
												3.6E-10	7.8E-10	mg/kg-day	NA	NA	NA				
												2.5E-10	5.6E-09	mg/kg-day	NA	NA	NA				
																2.9E-04					
																2.9E-04					
Exposure Point Total												1.7E-08					2.9E-04				
												1.7E-08					2.9E-04				
												1.7E-08					2.9E-04				
												1.7E-08					2.9E-04				
												1.7E-08					2.9E-04				
												1.7E-08					2.9E-04				
Medium Total												Total of Receptor Risks Across All Media	3.4E-05					Total of Receptor Hazards Across All Media	3.4E+00		

Note: (1) Adolescent trespasser is a person 6 to 17 years of age.

TABLE 7.7.CTE  
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS  
CENTRAL TENDENCY EXPOSURE  
ROLLING KNOLLS LANDFILL SUPERFUND SITE

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adolescent (1)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				Non-Cancer Hazard Calculations					
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Landfill	Ingestion	Volatile Organic Compounds												
				Benzene	1.2E+00	mg/kg	3.1E-08	mg/kg-day	5.5E-02	(mg/kg-day) <sup>1</sup>	1.7E-09	1.8E-07	mg/kg-day	4.0E-03	mg/kg-day	4.5E-05
				Chloroform	1.2E+02	mg/kg	3.0E-06	mg/kg-day	3.1E-02	(mg/kg-day) <sup>1</sup>	9.4E-08	1.8E-05	mg/kg-day	1.0E-02	mg/kg-day	1.8E-03
				Trichloroethene	4.1E-02	mg/kg					1.3E-10	6.0E-09	mg/kg-day	5.0E-04	mg/kg-day	1.2E-05
				Total xylenes	7.3E+03	mg/kg	1.9E-04	mg/kg-day	NA	NA	NA	1.1E-03	mg/kg-day	2.0E-01	mg/kg-day	5.4E-03
				Semi-Volatile Organic Compounds												
				Benzo(a)anthracene	5.1E+00	mg/kg					7.0E-08	7.8E-07	mg/kg-day	NA	NA	NA
				Benzo(a)pyrene	4.5E+00	mg/kg					6.1E-07	6.7E-07	mg/kg-day	3.0E-04	mg/kg-day	2.2E-03
				Benzo(b)fluoranthene	5.0E+00	mg/kg					6.8E-08	7.4E-07	mg/kg-day	NA	NA	NA
				Benzo(k)fluoranthene	4.1E+00	mg/kg					5.6E-03	6.1E-07	mg/kg-day	NA	NA	NA
				Bis(2-ethyl hexyl) phthalate	1.3E+01	mg/kg	3.2E-07	mg/kg-day	1.4E-02	(mg/kg-day) <sup>1</sup>	4.5E-09	1.9E-06	mg/kg-day	2.0E-02	mg/kg-day	9.4E-05
				Chrysene	5.4E+00	mg/kg					7.4E-10	8.1E-07	mg/kg-day	NA	NA	NA
				Dibenz(a,h)anthracene	5.3E+01	mg/kg					7.2E-08	7.9E-08	mg/kg-day	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	1.1E+00	mg/kg					1.5E-08	1.7E-07	mg/kg-day	NA	NA	NA
				Pesticides												
				Aldrin	1.2E-02	mg/kg	3.0E-10	mg/kg-day	1.7E+01	(mg/kg-day) <sup>1</sup>	5.0E-09	1.7E-09	mg/kg-day	3.0E-05	mg/kg-day	5.7E-05
				alpha-BHC	1.1E-02	mg/kg	2.9E-10	mg/kg-day	6.3E+00	(mg/kg-day) <sup>1</sup>	1.8E-09	1.7E-09	mg/kg-day	8.0E-03	mg/kg-day	2.1E-07
				alpha-Chlordane	1.8E-01	mg/kg	4.8E-09	mg/kg-day	3.5E-01	(mg/kg-day) <sup>1</sup>	1.8E-09	2.7E-08	mg/kg-day	5.0E-04	mg/kg-day	5.3E-05
				gamma-Chlordane	2.1E-01	mg/kg	5.4E-09	mg/kg-day	3.5E-01	(mg/kg-day) <sup>1</sup>	1.9E-09	3.1E-08	mg/kg-day	5.0E-04	mg/kg-day	6.3E-05
				Dieldrin	4.8E-02	mg/kg	1.2E-09	mg/kg-day	1.6E+01	(mg/kg-day) <sup>1</sup>	1.9E-08	6.8E-09	mg/kg-day	5.0E-05	mg/kg-day	1.4E-04
				Heptachlor	3.9E-02	mg/kg	1.0E-09	mg/kg-day	4.5E+00	(mg/kg-day) <sup>1</sup>	4.5E-09	5.8E-09	mg/kg-day	5.0E-04	mg/kg-day	1.2E-05
				Heptachlor epoxide	2.5E-02	mg/kg	6.3E-10	mg/kg-day	9.1E+00	(mg/kg-day) <sup>1</sup>	5.7E-09	3.7E-09	mg/kg-day	1.3E-05	mg/kg-day	2.8E-04
				Polychlorinated Biphenyls												
				Total Non-DL PCBs Congeners	5.7E+01	mg/kg	1.5E-08	mg/kg-day	1.0E+00	(mg/kg-day) <sup>1</sup>	1.5E-06	8.5E-06	mg/kg-day	2.0E-05	mg/kg-day	4.3E-01
				PCB TEQ	4.2E-04	mg/kg	1.1E-11	mg/kg-day	1.3E+05	(mg/kg-day) <sup>1</sup>	1.4E-06	6.2E-11	mg/kg-day	7.0E-10	mg/kg-day	8.9E-02
				Dioxin/Furans												
				Dioxin TEQ	4.9E-04	mg/kg	1.2E-11	mg/kg-day	1.6E+05	(mg/kg-day) <sup>1</sup>	1.9E-06	7.3E-11	mg/kg-day	7.0E-10	mg/kg-day	1.0E-01
				Inorganics												
				Aluminum	1.4E-04	mg/kg	3.5E-04	mg/kg-day	NA	NA	NA	2.0E-03	mg/kg-day	1.0E+00	mg/kg-day	2.0E-03
				Antimony	1.2E-02	mg/kg	3.0E-06	mg/kg-day	NA	NA	NA	1.8E-05	mg/kg-day	4.0E-04	mg/kg-day	4.4E-02
				Arsenic	2.6E+01	mg/kg	4.0E-07	mg/kg-day	1.5E+00	(mg/kg-day) <sup>1</sup>	5.9E-07	2.3E-06	mg/kg-day	3.0E-04	mg/kg-day	7.7E-03
				Barium	5.3E+02	mg/kg	1.4E-05	mg/kg-day	NA	NA	NA	7.9E-05	mg/kg-day	2.0E-01	mg/kg-day	3.9E-04
				Cadmium	1.4E-01	mg/kg	3.5E-07	mg/kg-day	NA	NA	NA	2.1E-06	mg/kg-day	1.0E-03	mg/kg-day	2.1E-03
				Chromium, Total	2.9E+02	mg/kg	7.3E-06	mg/kg-day	NA	NA	NA	4.3E-05	mg/kg-day	1.5E+00	mg/kg-day	2.8E-05
				Cobalt	1.3E-01	mg/kg	3.2E-07	mg/kg-day	NA	NA	NA	1.9E-06	mg/kg-day	3.0E-04	mg/kg-day	6.3E-03
				Copper	3.1E+03	mg/kg	7.8E-05	mg/kg-day	NA	NA	NA	4.5E-04	mg/kg-day	4.0E-02	mg/kg-day	1.1E-02
				Cyanide	1.5E-01	mg/kg	3.9E-07	mg/kg-day	NA	NA	NA	2.3E-06	mg/kg-day	6.0E-04	mg/kg-day	3.8E-03

TABLE 7.7.CTE  
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS  
CENTRAL TENDENCY EXPOSURE  
ROLLING KNOLLS LANDFILL SUPERFUND SITE

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent (1)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				Non-Cancer Hazard Calculations					
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (cont.)	Surface Soil (cont.)	Landfill (cont.)	Ingestion (cont.)	Iron	1.3E+05	mg/kg	3.2E-03	mg/kg-day	NA	NA	NA	1.9E-02	mg/kg-day	7.0E-01	mg/kg-day	2.7E-02
				Manganese	1.2E+03	mg/kg	3.0E-05	mg/kg-day	NA	NA	NA	1.7E-04	mg/kg-day	2.4E-02	mg/kg-day	7.3E-03
				Mercury	1.0E+01	mg/kg	2.5E-07	mg/kg-day	NA	NA	NA	1.5E-06	mg/kg-day	3.0E-04	mg/kg-day	5.0E-03
				Nickel	1.5E+02	mg/kg	3.9E-06	mg/kg-day	NA	NA	NA	2.3E-05	mg/kg-day	2.0E-02	mg/kg-day	1.1E-03
				Silver	1.0E+01	mg/kg	2.8E-07	mg/kg-day	NA	NA	NA	1.5E-06	mg/kg-day	5.0E-03	mg/kg-day	3.1E-04
				Thallium	9.7E-01	mg/kg	2.5E-08	mg/kg-day	NA	NA	NA	1.4E-07	mg/kg-day	1.0E-05	mg/kg-day	1.4E-02
				Vanadium	3.1E+02	mg/kg	7.9E-06	mg/kg-day	NA	NA	NA	4.5E-05	mg/kg-day	5.0E-03	mg/kg-day	9.1E-03
				Zinc	5.2E+03	mg/kg	1.3E-04	mg/kg-day	NA	NA	NA	7.7E-04	mg/kg-day	3.0E-01	mg/kg-day	2.6E-03
				Exp. Route Total								6.4E-06				7.7E-01
Soil	Surface Soil	Landfill	Dermal	Volatile Organic Compounds												
				Benzene	1.2E+00	mg/kg	NA	NA	5.5E-02	(mg/kg-day) <sup>1</sup>	NA	NA	NA	4.0E-03	mg/kg-day	NA
				Chloroform	1.2E+02	mg/kg	NA	NA	3.1E-02	(mg/kg-day) <sup>1</sup>	NA	NA	NA	1.0E-02	mg/kg-day	NA
				Trichloroethene	4.1E-02	mg/kg					7.2E-12	NA	NA	5.0E-04	mg/kg-day	NA
				Total xylenes	7.3E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	2.0E-01	mg/kg-day	NA
				Semi-Volatile Organic Compounds												
				Benzo(a)anthracene	5.1E+00	mg/kg					4.0E-09	8.7E-08	mg/kg-day	NA	NA	NA
				Benzo(a)pyrene	4.5E+00	mg/kg					3.5E-08	7.6E-08	mg/kg-day	3.0E-04	mg/kg-day	2.5E-04
				Benzo(b)fluoranthene	5.0E+00	mg/kg					3.8E-09	8.4E-08	mg/kg-day	NA	NA	NA
				Benzo(k)fluoranthene	4.1E+00	mg/kg					3.2E-10	6.9E-08	mg/kg-day	NA	NA	NA
				Bis(2-ethyl hexyl) phthalate	1.3E+01	mg/kg	2.8E-08	mg/kg-day	1.4E-02	(mg/kg-day) <sup>1</sup>	3.9E-10	1.6E-07	mg/kg-day	2.0E-02	mg/kg-day	8.2E-08
				Chrysene	5.4E+00	mg/kg					4.2E-11	9.2E-08	mg/kg-day	NA	NA	NA
				Dibenz(a,h)anthracene	5.3E+01	mg/kg					4.1E-09	9.0E-09	mg/kg-day	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	1.1E+00	mg/kg					8.6E-10	1.9E-08	mg/kg-day	NA	NA	NA
				Pesticides												
				Aldrin	1.2E-02	mg/kg	2.6E-11	mg/kg-day	1.7E+01	(mg/kg-day) <sup>1</sup>	4.4E-10	1.5E-10	mg/kg-day	3.0E-05	mg/kg-day	5.0E-06
				alpha-BHC	1.1E-02	mg/kg	2.5E-11	mg/kg-day	6.3E+00	(mg/kg-day) <sup>1</sup>	1.6E-10	1.5E-10	mg/kg-day	8.0E-03	mg/kg-day	1.8E-08
				alpha-Chlordane	1.8E-01	mg/kg	1.6E-10	mg/kg-day	3.5E-01	(mg/kg-day) <sup>1</sup>	5.6E-11	9.3E-10	mg/kg-day	5.0E-04	mg/kg-day	1.9E-08
				gamma-Chlordane	2.1E-01	mg/kg	1.9E-10	mg/kg-day	3.5E-01	(mg/kg-day) <sup>1</sup>	6.6E-11	1.1E-09	mg/kg-day	5.0E-04	mg/kg-day	2.2E-08
				Dieldrin	4.8E-02	mg/kg	1.0E-10	mg/kg-day	1.8E+01	(mg/kg-day) <sup>1</sup>	1.6E-09	8.0E-10	mg/kg-day	5.0E-05	mg/kg-day	1.2E-05
				Heptachlor	3.9E-02	mg/kg	8.8E-11	mg/kg-day	4.5E+00	(mg/kg-day) <sup>1</sup>	3.9E-10	5.1E-10	mg/kg-day	5.0E-04	mg/kg-day	1.0E-06
				Heptachlor epoxide	2.5E-02	mg/kg	5.5E-11	mg/kg-day	9.1E+00	(mg/kg-day) <sup>1</sup>	5.0E-10	3.2E-10	mg/kg-day	1.3E-05	mg/kg-day	2.5E-05
				Polychlorinated Biphenyls												
				Total Non-DL PCBs Congeners	5.7E+01	mg/kg	1.8E-07	mg/kg-day	1.0E+00	(mg/kg-day) <sup>1</sup>	1.8E-07	1.0E-06	mg/kg-day	2.0E-05	mg/kg-day	5.2E-02
				PCB TEQ	4.2E-04	mg/kg	1.3E-12	mg/kg-day	1.3E+05	(mg/kg-day) <sup>1</sup>	1.7E-07	7.6E-12	mg/kg-day	7.0E-10	mg/kg-day	1.1E-02

TABLE 7.7.CTE  
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS  
CENTRAL TENDENCY EXPOSURE  
ROLLING KNOLLS LANDFILL SUPERFUND SITE

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent (1)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations						Non-Cancer Hazard Calculations					
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient		
							Value	Units	Value	Units		Value	Units	Value	Units			
Soil (cont.)	Surface Soil (cont.)	Landfill (cont.)	Dermal (cont.)	Dioxin/Furans	4.9E-04	mg/kg	3.3E-13	mg/kg-day	1.6E+05	(mg/kg-day) <sup>-1</sup>	5.1E-08	1.9E-12	mg/kg-day	7.0E-10	mg/kg-day	2.7E-03		
				Inorganics														
				Aluminum	1.4E-04	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.0E+00	mg/kg-day	NA		
				Antimony	1.2E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.0E-04	mg/kg-day	NA		
				Arsenic	2.6E-01	mg/kg	1.7E-08	mg/kg-day	1.5E+00	(mg/kg-day) <sup>-1</sup>	2.6E-08	1.0E-07	mg/kg-day	3.0E-04	mg/kg-day	3.4E-04		
				Barium	5.3E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	2.0E-01	mg/kg-day	NA		
				Cadmium	1.4E-01	mg/kg	1.8E-10	mg/kg-day	NA	NA	NA	NA	1.8E-09	mg/kg-day	2.5E-05	mg/kg-day	7.2E-05	
				Chromium, Total	2.9E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	2.0E-02	mg/kg-day	NA		
				Cobalt	1.3E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.0E-04	mg/kg-day	NA		
				Copper	3.1E-03	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.0E-02	mg/kg-day	NA		
				Cyanide	1.5E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.0E-04	mg/kg-day	NA		
				Iron	1.3E-05	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.0E-01	mg/kg-day	NA		
				Manganese	1.2E-03	mg/kg	NA	NA	NA	NA	NA	NA	NA	2.4E-02	mg/kg-day	NA		
				Mercury	1.0E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.0E-04	mg/kg-day	NA		
				Nickel	1.5E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	2.0E-02	mg/kg-day	NA		
				Silver	1.0E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.0E-03	mg/kg-day	NA		
				Thallium	9.7E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.0E-05	mg/kg-day	NA		
				Vanadium	3.1E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.0E-03	mg/kg-day	NA		
				Zinc	5.2E-03	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.0E-01	mg/kg-day	NA		
				Exp. Route Total									4.8E-07				6.7E-02	
Soil	Surface Soil	Landfill	Inhalation	Volatile Organic Compounds														
				Benzene	1.2E-00	mg/kg	4.8E-04	µg/m <sup>3</sup>	7.8E-06	(µg/m <sup>3</sup> ) <sup>-1</sup>	3.8E-09	2.8E-03	µg/m <sup>3</sup>	3.0E+01	µg/m <sup>3</sup>	9.4E-05		
				Chloroform	1.2E-02	mg/kg	7.8E-02	µg/m <sup>3</sup>	2.3E-05	(µg/m <sup>3</sup> ) <sup>-1</sup>	1.8E-06	4.4E-01	µg/m <sup>3</sup>	9.8E+01	µg/m <sup>3</sup>	4.5E-03		
				Trichloroethene	4.1E-02	mg/kg	See Calculations in Appendix G				5.0E-09	1.7E-04	µg/m <sup>3</sup>	2.0E+00	µg/m <sup>3</sup>	8.5E-05		
				Total xylenes	7.3E-03	mg/kg	1.7E-00	µg/m <sup>3</sup>	NA	NA	NA	1.0E-01	µg/m <sup>3</sup>	1.0E+02	µg/m <sup>3</sup>	1.0E-01		
				Semi-Volatile Organic Compounds														
				Benzo(a)anthracene	5.1E-00	mg/kg	See Calculations in Appendix G				2.8E-12	1.3E-07	µg/m <sup>3</sup>	NA	NA	NA		
				Benzo(a)pyrene	4.5E+00	mg/kg	See Calculations in Appendix G				2.5E-11	1.1E-07	µg/m <sup>3</sup>	2.0E-03	µg/m <sup>3</sup>	5.7E-05		
				Benzo(b)fluoranthene	5.0E+00	mg/kg	See Calculations in Appendix G				2.7E-12	1.3E-07	µg/m <sup>3</sup>	NA	NA	NA		
				Benzo(k)fluoranthene	4.1E+00	mg/kg	See Calculations in Appendix G				2.2E-13	1.0E-07	µg/m <sup>3</sup>	NA	NA	NA		
				Bis(2-ethyl hexyl) phthalate	1.3E-01	mg/kg	5.5E-08	µg/m <sup>3</sup>	2.4E-06	(µg/m <sup>3</sup> ) <sup>-1</sup>	1.3E-13	3.2E-07	µg/m <sup>3</sup>	NA	NA	NA		
				Chrysene	5.4E+00	mg/kg	See Calculations in Appendix G				2.9E-14	1.4E-07	µg/m <sup>3</sup>	NA	NA	NA		
				Dibenz(a,h)anthracene	5.3E-01	mg/kg	See Calculations in Appendix G				2.9E-12	1.4E-08	µg/m <sup>3</sup>	NA	NA	NA		
				Indeno(1,2,3-cd)pyrene	1.1E+00	mg/kg	See Calculations in Appendix G				7.8E-13	2.8E-08	µg/m <sup>3</sup>	NA	NA	NA		

TABLE 7.7.CTE  
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS  
CENTRAL TENDENCY EXPOSURE  
ROLLING KNOLLS LANDFILL SUPERFUND SITE

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adolescent (1)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				Non-Cancer Hazard Calculations					
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (cont.)	Surface Soil (cont.)	Landfill (cont.)	Inhalation (cont.)	Pesticides												
				Aldrin	1.2E-02	mg/kg	5.0E-11	µg/m³	4.8E-03	(µg/m³)⁻¹	2.5E-13	2.9E-10	µg/m³	NA	NA	NA
				alpha-BHC	1.1E-02	mg/kg	4.9E-11	µg/m³	1.8E-03	(µg/m³)⁻¹	8.8E-14	2.9E-10	µg/m³	NA	NA	NA
				alpha-Chlordane	1.8E-01	mg/kg	7.8E-10	µg/m³	1.0E-04	(µg/m³)⁻¹	7.8E-14	4.6E-09	µg/m³	7.0E-01	µg/m³	6.5E-09
				gamma-Chlordane	2.1E-01	mg/kg	9.2E-10	µg/m³	1.0E-04	(µg/m³)⁻¹	9.2E-14	5.4E-09	µg/m³	7.0E-01	µg/m³	7.7E-09
				Dieldrin	4.6E-02	mg/kg	2.0E-10	µg/m³	4.6E-03	(µg/m³)⁻¹	9.2E-13	1.2E-09	µg/m³	NA	NA	NA
				Heptachlor	3.9E-02	mg/kg	1.7E-10	µg/m³	1.3E-03	(µg/m³)⁻¹	2.2E-13	1.0E-09	µg/m³	NA	NA	NA
				Heptachlor epoxide	2.5E-02	mg/kg	1.1E-10	µg/m³	2.6E-03	(µg/m³)⁻¹	2.8E-13	6.3E-10	µg/m³	NA	NA	NA
				Polychlorinated Biphenyls												
				Total Non-DL PCBs Congeners	5.7E-01	mg/kg	2.5E-07	µg/m³	2.8E-04	(µg/m³)⁻¹	7.1E-11	1.5E-06	µg/m³	NA	NA	NA
				PCB TEQ	4.2E-04	mg/kg	1.8E-12	µg/m³	3.8E+01	(µg/m³)⁻¹	6.9E-11	1.1E-11	µg/m³	4.0E-05	µg/m³	2.7E-07
				Dioxin/Furans												
				Dioxin TEQ	4.9E-04	mg/kg	2.1E-12	µg/m³	3.8E+01	(µg/m³)⁻¹	8.1E-11	1.2E-11	µg/m³	4.0E-05	µg/m³	3.1E-07
				Inorganics												
				Aluminum	1.4E+04	mg/kg	5.9E-05	µg/m³	NA	NA	NA	3.5E-04	µg/m³	5.0E+00	µg/m³	6.9E-05
				Antimony	1.2E+02	mg/kg	5.2E-07	µg/m³	NA	NA	NA	3.0E-06	µg/m³	NA	NA	NA
				Arsenic	2.6E+01	mg/kg	1.1E-07	µg/m³	4.3E-03	(µg/m³)⁻¹	4.8E-10	6.8E-07	µg/m³	1.5E-02	µg/m³	4.4E-05
				Barium	5.3E+02	mg/kg	2.3E-06	µg/m³	NA	NA	NA	1.3E-05	µg/m³	5.0E-01	µg/m³	2.7E-05
				Cadmium	1.4E+01	mg/kg	6.0E-08	µg/m³	1.8E-03	(µg/m³)⁻¹	1.1E-10	3.5E-07	µg/m³	1.0E-02	µg/m³	3.5E-05
				Chromium, Total	2.9E+02	mg/kg	1.2E-06	µg/m³	NA	NA	NA	7.3E-06	µg/m³	NA	NA	NA
				Cobalt	1.3E+01	mg/kg	5.5E-08	µg/m³	9.0E-03	(µg/m³)⁻¹	5.0E-10	3.2E-07	µg/m³	6.0E-03	µg/m³	5.4E-05
				Copper	3.1E+03	mg/kg	1.3E-05	µg/m³	NA	NA	NA	7.8E-05	µg/m³	NA	NA	NA
				Cyanide	1.5E+01	mg/kg	6.7E-08	µg/m³	NA	NA	NA	3.9E-07	µg/m³	NA	NA	NA
				Iron	1.3E+05	mg/kg	5.5E-04	µg/m³	NA	NA	NA	3.2E-03	µg/m³	NA	NA	NA
				Manganese	1.2E+03	mg/kg	5.1E-08	µg/m³	NA	NA	NA	3.0E-05	µg/m³	5.0E-02	µg/m³	6.0E-04
				Mercury	1.0E+01	mg/kg	4.4E-08	µg/m³	NA	NA	NA	2.5E-07	µg/m³	3.0E-01	µg/m³	8.5E-07
				Nickel	1.5E+02	mg/kg	6.7E-07	µg/m³	2.8E-04	(µg/m³)⁻¹	1.7E-10	3.9E-06	µg/m³	9.0E-02	µg/m³	4.4E-05
				Silver	1.0E+01	mg/kg	4.5E-08	µg/m³	NA	NA	NA	2.6E-07	µg/m³	NA	NA	NA
				Thallium	9.7E-01	mg/kg	4.2E-09	µg/m³	NA	NA	NA	2.4E-08	µg/m³	NA	NA	NA
				Vanadium	3.1E+02	mg/kg	1.3E-06	µg/m³	NA	NA	NA	7.7E-06	µg/m³	1.0E-01	µg/m³	7.7E-05
				Zinc	5.2E+03	mg/kg	2.3E-05	µg/m³	NA	NA	NA	1.3E-04	µg/m³	3.0E-01	µg/m³	4.4E-04
				Exp. Route Total							1.8E-06				1.1E-01	
				Exposure Point Total							8.6E-06				9.5E-01	
				Exposure Medium Total							8.6E-06				9.5E-01	
Medium Total											8.6E-06				9.5E-01	

TABLE 7.7.CTE  
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS  
CENTRAL TENDENCY EXPOSURE  
ROLLING KNOLLS LANDFILL SUPERFUND SITE

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent (1)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				Non-Cancer Hazard Calculations						
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient	
							Value	Units	Value	Units		Value	Units	Value	Units		
Surface Water	Surface Water	Ponds	Dermal	Volatile Organic Compounds	Benzene cis-1,2-Dichloroethene 1,4-Dioxane Trichloroethene Vinyl chloride	3.3E-01 6.9E+00 4.5E+00 2.0E+00 1.9E-01	µg/L µg/L µg/L µg/L µg/L	2.4E-09	mg/kg-day	5.5E-02	(mg/kg-day) <sup>-1</sup>	1.3E-10	1.4E-08	mg/kg-day	4.0E-03	mg/kg-day	3.5E-06
							NA	NA	NA	NA	NA	NA	NA	2.0E-03	mg/kg-day	NA	
							7.8E-10	mg/kg-day	1.0E-01	(mg/kg-day) <sup>-1</sup>	7.8E-11	4.5E-09	mg/kg-day	3.0E-02	mg/kg-day	1.5E-07	
							See Calculations in Appendix G				5.3E-09	8.0E-08	mg/kg-day	5.0E-04	mg/kg-day	1.6E-04	
							See Calculations in Appendix G				1.6E-07	3.0E-09	mg/kg-day	3.0E-03	mg/kg-day	1.0E-06	
							See Calculations in Appendix G				6.1E-08	1.3E-07	mg/kg-day	NA	NA	NA	
							7.0E-10	mg/kg-day	1.5E+00	(mg/kg-day) <sup>-1</sup>	1.1E-09	4.1E-09	mg/kg-day	3.0E-04	mg/kg-day	1.4E-05	
							6.2E-10	mg/kg-day	NA	NA	NA	3.6E-09	mg/kg-day	2.0E-02	mg/kg-day	1.9E-07	
							4.9E-10	mg/kg-day	NA	NA	NA	2.8E-09	mg/kg-day	3.0E-04	mg/kg-day	9.4E-08	
							NA	NA	NA	NA	NA	NA	NA	7.0E-01	mg/kg-day	NA	
				Inorganics	Arsenic Chromium, Total Cobalt Iron Manganese	1.8E-02 1.5E+00 1.2E+00 7.8E+03 3.2E+02	µg/L µg/L µg/L ug/L µg/L	1.3E-07	mg/kg-day	NA	NA	NA	7.8E-07	mg/kg-day	2.4E-02	mg/kg-day	3.2E-05
								See Calculations in Appendix G				See Calculations in Appendix G				2.2E-04	
								2.3E-07				2.3E-07				2.2E-04	
								See Calculations in Appendix G				2.3E-07				2.2E-04	
								2.3E-07				2.3E-07				2.2E-04	
								See Calculations in Appendix G				2.3E-07				2.2E-04	
								2.3E-07				2.3E-07				2.2E-04	
								2.3E-07				2.3E-07				2.2E-04	
Sediment	Sediment	Ponds	Dermal	Semi-Volatile Organic Compounds	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Dibenz(a,h)anthracene Indeno(1,2,3-cd)pyrene	7.3E-01 1.1E+00 1.2E+00 5.0E-01 8.5E-01 9.2E-02 6.8E-01	mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	See Calculations in Appendix G				4.0E-11	8.8E-10	mg/kg-day	NA	NA	NA
								See Calculations in Appendix G				5.9E-10	1.3E-09	mg/kg-day	3.0E-04	mg/kg-day	4.3E-06
								See Calculations in Appendix G				6.7E-11	1.5E-09	mg/kg-day	NA	NA	NA
								See Calculations in Appendix G				2.7E-12	6.0E-10	mg/kg-day	NA	NA	NA
								See Calculations in Appendix G				4.7E-13	1.0E-09	mg/kg-day	NA	NA	NA
								See Calculations in Appendix G				5.1E-11	1.1E-10	mg/kg-day	NA	NA	NA
								See Calculations in Appendix G				3.6E-11	8.0E-10	mg/kg-day	NA	NA	NA
								See Calculations in Appendix G				4.9E-11	2.9E-10	mg/kg-day	2.0E-05	mg/kg-day	1.4E-05
								See Calculations in Appendix G				1.8E-09	6.1E-09	mg/kg-day	3.0E-04	mg/kg-day	2.0E-05
								See Calculations in Appendix G				4.9E-11	4.9E-11	mg/kg-day	2.5E-05	mg/kg-day	2.0E-06
Medium Total				Exp. Route Total							2.4E-09				4.1E-05		
																4.1E-05	
																4.1E-05	
																4.1E-05	
																4.1E-05	
Medium Total				Exposure Point Total							2.4E-09				4.1E-05		
																4.1E-05	
Total of Receptor Risks/Hazards Across All Media														8.8E-06	Total of Receptor Hazards Across All Media	9.5E-01	

Note: (1) Adolescent trespasser is a person 6 to 17 years of age.

**ATTACHMENT B-2**

**PROUCL INPUT AND OUTPUT**

	Aroclors	D_Aroclors
POI-11	0.05	0
POI-14	0.04	1
POI-15	0.03	0
POI-16	0.03	0
POI-2	2.18	1
POI-3	0.64	1
POI-4	0.89	0
POI-5	0.06	0
POI-6	0.16	1
POI-7	0.04	0
POI-8	0.11	1
POI-9	1.97	1
SS-100	4.06	1
SS-101	7.3	1
SS-102	4.22	1
SS-103	5.55	1
SS-104	5.57	1
SS-105	9.31	1
SS-106	0.86	1
SS-107	0.32	1
SS-108	0.48	1
SS-109	0.09	1
SS-110	1.28	1
SS-111	0.64	1
SS-112	0.03	1
SS-113	2.29	1
SS-114	1.17	1
SS-115	0.78	1
SS-116	0.04	0
SS-117	2.66	1
SS-118	23	1
SS-119	2.3	1
SS-120	3.4	1
SS-121	8.6	1
SS-122	1.28	1
SS-123	3.15	1
SS-124	1.48	1
SS-159	0.01	1
SS-16	0.04	0
SS-17	0.11	1
SS-178	0.04	0
SS-18	0.04	1
SS-19	2.8	1
SS-20	0.04	0
SS-21	0.73	1
SS-22	0.71	1

SS-23	0.43	1
SS-24	4.7	1
SS-25	0.03	0
SS-26	0.03	0
SS-27	0.03	0
SS-28	0.03	0
SS-29	0.03	0
SS-30	0.03	0
SS-31	0.03	0
SS-32	0.03	0
SS-33	0.03	0
SS-34	0.03	0
SS-35	0.03	0
SS-36	2.06	1
SS-37	0.04	1
SS-38	0.03	1
SS-40	1.56	1
SS-41	0.04	0
SS-42	1.84	1
SS-43	0.19	1
SS-44	1.83	1
SS-47	5.35	1
SS-48	4.4	1
SS-49	5.6	1
SS-50	3.4	1
SS-51	5.45	1
SS-53	10.9	1
SS-54	0.03	1
SS-55	3.54	1
SS-60	6	1
SS-61	0.05	0
SS-62	0.14	1
SS-64	3.99	1
SS-67	1.32	1
SS-68	4.99	1
SS-69	0.07	0
SS-71	1.1	1
SS-72	7.07	1
SS-73	4.49	1
SS-74	0.21	1
SS-75	4.17	1
SS-76	0.04	0
SS-77	2.16	1
SS-78	0.04	0
SS-79	4	1
SS-80	0.4	1
SS-81	7.8	1

SS-82	3.1	1
SS-83	0.03	0
SS-84	10.6	1
SS-85	3.74	1
SS-86	0.06	0
SS-87	8.7	1
SS-88	7.29	1
SS-89	0.28	1
SS-90	29	1
SS-91	4.58	1
SS-92	0.11	0
SS-93	0.02	1
SS-94	5.03	1
SS-95	2.46	1
SS-96	2	1
SS-97	15.7	1
SS-98	7.51	1
SS-99	0.08	1

	A	B	C	D	E	F	G	H	I	J	K	L												
1	UCL Statistics for Data Sets with Non-Detects																							
2																								
3	User Selected Options																							
4	Date/Time of Computation		ProUCL 5.17/10/2018 1:35:32 PM																					
5	From File		arocltors - outside cap.xls																					
6	Full Precision		OFF																					
7	Confidence Coefficient		95%																					
8	Number of Bootstrap Operations		2000																					
9																								
10	Aroclos																							
11																								
12	General Statistics																							
13	Total Number of Observations			111	Number of Distinct Observations			78																
14	Number of Detects			82	Number of Non-Detects			29																
15	Number of Distinct Detects			74	Number of Distinct Non-Detects			7																
16	Minimum Detect			0.01	Minimum Non-Detect			0.03																
17	Maximum Detect			29	Maximum Non-Detect			0.89																
18	Variance Detects			22.46	Percent Non-Detects			26.13%																
19	Mean Detects			3.641	SD Detects			4.74																
20	Median Detects			2.235	CV Detects			1.302																
21	Skewness Detects			3.045	Kurtosis Detects			12.36																
22	Mean of Logged Detects			0.291	SD of Logged Detects			1.829																
23																								
24	Normal GOF Test on Detects Only																							
25	Shapiro Wilk Test Statistic			0.704	Normal GOF Test on Detected Observations Only																			
26	5% Shapiro Wilk P Value			0	Detected Data Not Normal at 5% Significance Level																			
27	Lilliefors Test Statistic			0.222	Lilliefors GOF Test																			
28	5% Lilliefors Critical Value			0.098	Detected Data Not Normal at 5% Significance Level																			
29	Detected Data Not Normal at 5% Significance Level																							
30																								
31	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs																							
32	KM Mean			2.696	KM Standard Error of Mean			0.415																
33	KM SD			4.35	95% KM (BCA) UCL			3.417																
34	95% KM (t) UCL			3.385	95% KM (Percentile Bootstrap) UCL			3.401																
35	95% KM (z) UCL			3.379	95% KM Bootstrap t UCL			3.612																
36	90% KM Chebyshev UCL			3.942	95% KM Chebyshev UCL			4.506																
37	97.5% KM Chebyshev UCL			5.29	99% KM Chebyshev UCL			6.829																
38																								
39	Gamma GOF Tests on Detected Observations Only																							
40	A-D Test Statistic			0.58	Anderson-Darling GOF Test																			
41	5% A-D Critical Value			0.807	Detected data appear Gamma Distributed at 5% Significance Level																			
42	K-S Test Statistic			0.0697	Kolmogorov-Smirnov GOF																			
43	5% K-S Critical Value			0.104	Detected data appear Gamma Distributed at 5% Significance Level																			
44	Detected data appear Gamma Distributed at 5% Significance Level																							
45																								
46	Gamma Statistics on Detected Data Only																							
47	k hat (MLE)			0.615	k star (bias corrected MLE)			0.6																
48	Theta hat (MLE)			5.923	Theta star (bias corrected MLE)			6.064																
49	nu hat (MLE)			100.8	nu star (bias corrected)			98.48																
50	Mean (detects)			3.641																				
51																								
52	Gamma ROS Statistics using Imputed Non-Detects																							
53	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs																							
54	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)																							
55	For such situations, GROS method may yield incorrect values of UCLs and BTVs																							

A	B	C	D	E	F	G	H	I	J	K	L
56	This is especially true when the sample size is small.										
57	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates										
58											
59	Minimum	0.01							Mean	2.693	
60	Maximum	29							Median	0.86	
61	SD	4.371							CV	1.623	
62	k hat (MLE)	0.341						k star (bias corrected MLE)		0.338	
63	Theta hat (MLE)	7.891						Theta star (bias corrected MLE)		7.966	
64	nu hat (MLE)	75.76						nu star (bias corrected)		75.04	
65	Adjusted Level of Significance ( $\beta$ )	0.0478									
66	Approximate Chi Square Value (75.04, $\alpha$ )	56.09						Adjusted Chi Square Value (75.04, $\beta$ )		55.88	
67	95% Gamma Approximate UCL (use when n>=50)	3.602						95% Gamma Adjusted UCL (use when n<50)		3.616	
68	Estimates of Gamma Parameters using KM Estimates										
69	Mean (KM)	2.696						SD (KM)		4.35	
70	Variance (KM)	18.92						SE of Mean (KM)		0.415	
71	k hat (KM)	0.384						k star (KM)		0.38	
72	nu hat (KM)	85.25						nu star (KM)		84.28	
73	theta hat (KM)	7.019						theta star (KM)		7.1	
74	80% gamma percentile (KM)	4.322						90% gamma percentile (KM)		7.683	
75	95% gamma percentile (KM)	11.4						99% gamma percentile (KM)		20.81	
76	Gamma Kaplan-Meier (KM) Statistics										
77	Approximate Chi Square Value (84.28, $\alpha$ )	64.12						Adjusted Chi Square Value (84.28, $\beta$ )		63.89	
78	95% Gamma Approximate KM-UCL (use when n>=50)	3.543						95% Gamma Adjusted KM-UCL (use when n<50)		3.556	
79											
80	Lognormal GOF Test on Detected Observations Only										
81	Shapiro Wilk Approximate Test Statistic	0.904						Shapiro Wilk GOF Test			
82	5% Shapiro Wilk P Value	1.1159E-6						Detected Data Not Lognormal at 5% Significance Level			
83	Lilliefors Test Statistic	0.153						Lilliefors GOF Test			
84	5% Lilliefors Critical Value	0.098						Detected Data Not Lognormal at 5% Significance Level			
85	Detected Data Not Lognormal at 5% Significance Level										
86	Lognormal ROS Statistics Using Imputed Non-Detects										
87	Mean in Original Scale	2.704						Mean in Log Scale		-0.635	
88	SD in Original Scale	4.365						SD in Log Scale		2.26	
89	95% t UCL (assumes normality of ROS data)	3.391						95% Percentile Bootstrap UCL		3.396	
90	95% BCA Bootstrap UCL	3.536						95% Bootstrap t UCL		3.642	
91	95% H-UCL (Log ROS)	14.95									
92											
93	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution										
94	KM Mean (logged)	-0.866						KM Geo Mean		0.421	
95	KM SD (logged)	2.51						95% Critical H Value (KM-Log)		3.963	
96	KM Standard Error of Mean (logged)	0.248						95% H-UCL (KM -Log)		25.37	
97	KM SD (logged)	2.51						95% Critical H Value (KM-Log)		3.963	
98	KM Standard Error of Mean (logged)	0.248									
99	DL/2 Statistics										
100	DL/2 Normal										
101	DL/2 Log-Transformed										
102	Mean in Original Scale	2.699						Mean in Log Scale		-0.79	
103	SD in Original Scale	4.368						SD in Log Scale		2.431	
104	95% t UCL (Assumes normality)	3.387						95% H-Stat UCL		21.34	
105	DL/2 is not a recommended method, provided for comparisons and historical reasons										
106	Nonparametric Distribution Free UCL Statistics										
107	Detected Data appear Gamma Distributed at 5% Significance Level										
108											
109											
110											

A	B	C	D	E	F	G	H	I	J	K	L
111											
112	<b>Suggested UCL to Use</b>										
113	95% KM Approximate Gamma UCL   3.543										
114	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
115	Recommendations are based upon data size, data distribution, and skewness.										
116	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
117	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
118											
119											